

IN THE SPECIFICATION

[0017] It has been discovered that ~~table-stable~~ catalyst carrier impregnating solutions can be prepared using a component of a Group VIB metal, e.g., molybdenum, at high concentration, a component of a Group VIII metal, e.g., nickel, at low concentration, and a phosphorous component, e.g., phosphoric acid, at low concentration, provided that the Group VIII metal is in a substantially water-insoluble form and a particular sequence of addition of the components is followed, even when a substantially water-insoluble form of the Group VIB component is used. The resulting stabilized impregnating solution can be supplemented with additional Group VIII metal in water-soluble form to achieve increased levels of such metal in the final catalyst. Furthermore, it has been discovered that uncalcined catalyst carriers impregnated with the stable solution and subsequently shaped, dried and calcined, have unexpectedly improved performance when used in hydrocarbon conversion processes, especially in the hydrodesulfurization, hydrodemetallation, hydrodenitrification and hydroconversion of heavy hydrocarbons. The catalyst is particularly useful in hydroconversion processes using heavy hydrocarbon feedstocks in which high conversion can be achieved at reduced levels of sediment, especially in comparison to standard commercial catalysts.

[0096] EXAMPLES

Stable Metals Solution and Catalyst Preparation Examples

Preparation of Impregnating Solution

Stable Metals Solution

Room temperature water (750 g) was placed in a glass kettle equipped with an overhead stirrer. Nickel carbonate (40% Ni; 116 g) was added to form a slurry. To the stirring slurry was added 75% orthophosphoric acid (52 g). The slurry was then

heated to 120 °F. Molybdenum trioxide (588 g) was added. After addition was complete, the temperature was raised to 190 °F and held for three hours. The solution was allowed to cool; the resulting solution corresponds to Example 1A+. Subsequent dilution of A1—1A with water to a final weight of 2280 g resulted in the solution of Example 1B. The theoretical concentration of metals for the diluted solution are 17.2% Mo, 2.0% Ni and 0.5 %P. Analysis of the solution showed 17.0% Mo, 2.2% Ni and 0.5% P.

[0106][0107] MCR = micro carbon residue and is described in ASTM Method D4530. Sediment, test method ASTM D4870; a reference to this test appears in US 5,928,499 (Column 13, lines 31-42). In the figure illustrating sediment vs. conversion, Figure 3, the dotted line separates data collected at 795 °F (left) from data collected at 805 °F (right). As for sediment, sediment is the insoluble material (captured by filtration) that is found in the feed or product. This is to be contrasted with carbon residue which is the material left after pyrolyzing the feed or product. The sediment level for the resid feedstocks typically is very low. There are both sediment molecules and sediment precursor molecules in the feed, but the sediment molecules are soluble in the feed and therefore are not captured via filtration. Upon conversion of the 1000°F+ materials, the sediment precursor molecules become sediment molecules, and it is believed that the solubility properties of the product are diminished compared to the feed. Therefore, more severe operations lead to higher observed sediment. Less sediment is observed with better performing catalysts and this is believed due to either production of less sediment molecules or conversion of the feed in such a way that the products have better solubility properties, or both.

{0107}[0108] Percent conversion for all parameters is calculated using the following equation:

$\frac{[(\text{amount X in feed} - \text{amount X in product})/\text{amount X in feed}]}{\text{feed}} * 100$

{0108}[0109] For example, for 1000°F+ conversion, it would be the volume of 1000°F+ boiling material in the feed (for a certain period of time corresponding to the balance period being considered for the pilot plant) minus the volume of 1000°F+ boiling material in the product (over that same period of time), this quantity divided by the volume of 1000°F+ boiling material in the feed, all times 100. The same calculation procedure is used for sulfur and MCR.

{0109}[0110] Performance of the catalysts is shown in Figures 1, 2 and 3. In each instance it can be seen that the catalyst examples of the invention performed better than the comparative catalyst: improved sulfur conversion, particularly at extended run length; improved microcarbon residue conversion; and reduced sediment versus 1000°F+ conversion. Typical results at equivalent conversion were as follows:

Catalyst	HDS Conversion (%)*	1000°F+ Conversion (%)	Sediment (ppmw)
Ex. 1	85	59	3000
Ex. 2	83	61	4000
Comparative	79	60	6000

\* at approximately 180 hrs. on feed (Fig. 2)

{0110}[0111] Any range of numbers recited in the specification, or paragraphs hereinafter, describing various aspects of the invention, such as that representing a particular set of properties, units of measure, conditions, physical states or percentages, is intended literally to incorporate expressly herein by reference or otherwise, any number falling within such range, including any subset of numbers or ranges subsumed within any range so recited. Additionally, the term "about" when used

as a modifier for, or in conjunction with, a variable, is intended to convey that the values and ranges disclosed herein are flexible and that practice of the present invention by those skilled in the art using, e.g., temperatures, concentrations, amounts, contents, carbon numbers, properties such as viscosity, particle size, surface area, solubility, etc., that are outside of the stated range or different from a single value, will achieve the desired result, namely, preparation of aqueous compositions useful for impregnating foraminous carriers, methods of impregnating such carriers, the catalysts obtained thereby and the use of such catalysts in hydroconversion processes.

[0111] [0112] The principles, preferred embodiments, and modes of operation of the present invention have been described in the foregoing specification. The invention which is intended to be protected herein, however, is not to be construed as limited to the particular forms disclosed, since these are to be regarded as illustrative rather than restrictive. Variations and changes may be made by those skilled in the art, without departing from the spirit of the invention.